Autosomal recessive hydrocephalus with aqueductal stenosis

Abstract We report the case histories of three sisters with congenital hydrocephalus associated with stenosis of the cerebral aqueduct. The parents were a young consanguineous couple. In two cases hydrocephalus was detected before birth by ultrasound. We consider these three cases to be of the rare autosomal form of hereditary hydrocephalus.

Key words Hydrocephalus · Cerebral aqueduct · Autosomal recessive hydrocephalus

Introduction

Dandy [9, 10] stated that stenosis of the cerebral aqueduct is the most common cause of congenital hydrocephalus. This was first postulated by Schlapp and Gere in 1917 [33] and has largely been accepted since then [3, 8, 20, 21, 25, 31, 36]. In 1949, Bickers and Adams described a family in which seven male children displayed hydrocephalus at birth. Postmortem examination of one of the children revealed stenosis of the cerebral aqueduct, and genealogical analysis suggested that the disorder was an X-linked recessive trait [3]. Hydrocephalus due to an X-linked recessive trait has been detected in numerous subsequent studies of affected families [11–14, 16–20, 24, 26, 35, 37, 40, 41, 44]. However, hydrocephalus has also been reported to occur very rarely as an autosomal recessive trait that affects both sexes and may or may not be associated with aqueductal stenosis [1, 2, 6, 29, 32, 34, 38, 39, 47]. Here, we report a family with three hydrocephalic children. The hydrocephalus was associated with stenosis of the cerebral aqueduct and appears to have been inherited as an autosomal recessive trait.

Case reports

Case 1

This child, the second of the five girls of a consanguineous couple (see family tree, Fig. 1), was brought to our Pediatric Neurology Unit with macrocephaly when she was 3 years old. Her younger sister (case 2; born about 1 year later) had been diagnosed as hydrocephalic during gestation; by the time child 1 was brought to us, the diagnosis for child 2 (then 2 years old) was congenital hydrocephalus with stenosis of the cerebral aqueduct. The gestation and birth of child 1 were normal, with a birth weight of 2350 g. We do not know her head circumference at birth. She was able to sit up unaided at 12 months and to walk at 18 months. When she was brought to us at 3 years of age, her head circumference was 54 cm (more than 4 standard deviations greater than the mean), and she displayed ataxia of gait with walking on a wide base. Intelligence test results were normal. Electroencephalography revealed a disorganized high-voltage sleeping trace, although no between-hemisphere asymmetries or focal signs were detected. Computed tomography revealed obstructive hydrocephalus with stenosis of the cerebral aqueduct. Ophthalmological examination revealed a small area of chorioretinitis in both eyes, with no evidence of edema of the discus nervi optici. Torchl serological testing gave negative results.

These findings indicated implantation of a ventriculoperitoneal shunt, but permission was refused by the parents. We did not see the child again until she was 10 years, 10 months old, when she was
brought to us with headaches and vomiting. Her head circumference at this time was 68 cm, and her general health good. She presented esotropia of the left eye and retained the areas of chorioretinitis observed previously, again without edema of the discus nervi optici. Visual acuity was normal. She showed ataxic gait, generalized hyperreflexia and spasticity, and severe static tremor which worsened under emotional stress. Cognitive abilities and general awareness were normal. Computed tomography revealed the degree of ventricular dilatation to be much greater than at the previous examination (Evans’ index = 0.56); thickness of the cerebral cortex 1.0 cm in the frontal region and 0.5 cm in the occipital region (Fig. 2). Karyotype was normal.

In view of the above evidence of decompensation, a ventriculoperitoneal shunt was implanted. Following surgery, the headaches and vomiting disappeared and there was some improvement in gait; however, bilateral subdural hygroma became manifest.

Case 2

This child (sister of child 1) was diagnosed as hydrocephalic during routine ultrasonographic examination at 38 weeks after last menstruation. Due to cephalopelvic disproportion, delivery was by cesarean section. The 1-min Apgar score was very low [2], necessitating radical resuscitation procedures (5- and 10-min scores 7 and 9, respectively). The infant was severely macrocephalic (head circumference 45.5 cm), with pronounced diastasis of the sutures and down-gazing eyes. Birth weight was 3360 g, and body length 50 cm. Computed tomography revealed severe obstructive hydrocephalus with stenosis of the cerebral aqueduct. Electroencephalography revealed regular alternating paroxysm. Ophthalmological examination did not reveal any abnormalities. Torch serological testing gave negative results. Karyotype was normal. Shunt implantation was not carried out. The patient died at age 3.

Case 3

This girl was the fifth child of the same couple. She was delivered in another hospital at 40 weeks after last menstruation, again by cesarean section due to ultrasonographic detection of hydrocephaly and cephalopelvic disproportion. Apgar scores were very severely depressed (1, 2 and 7 at 1, 5 and 10 min, respectively). Like child 2, she presented severe macrocephaly (head circumference 47.5 cm), pronounced diastasis of the sutures and down-gazing eyes. Birth weight was 3260 g and body length 50 cm. Computed tomography revealed severe obstructive hydrocephalus with spontaneous ventriculostomy; the cerebral cortex was thin in the frontal region and extremely thin in the occipital and temporal regions; Evans’ index was 0.44 (Fig. 3). Electroencephalography revealed a disorganized trace with frequent point discharges and point-wave complexes in the left hemisphere. Torch serological testing gave negative results. Karyotype was normal. Routine screening did not reveal metabolic disorders. A ventriculoperitoneal shunt was implanted. Following surgery, ventriculitis developed, and the infant died at 25 days of age.

The karyotypes of the parents and their two healthy daughters were all normal.

Discussion

In addition to the relatively common X-linked recessive hydrocephalus, there have been occasional reports of an autosomal recessive form. The cases reported here appear to be of this rarer autosomal form, since all three affected children were girls. In all three cases, neuroradiological